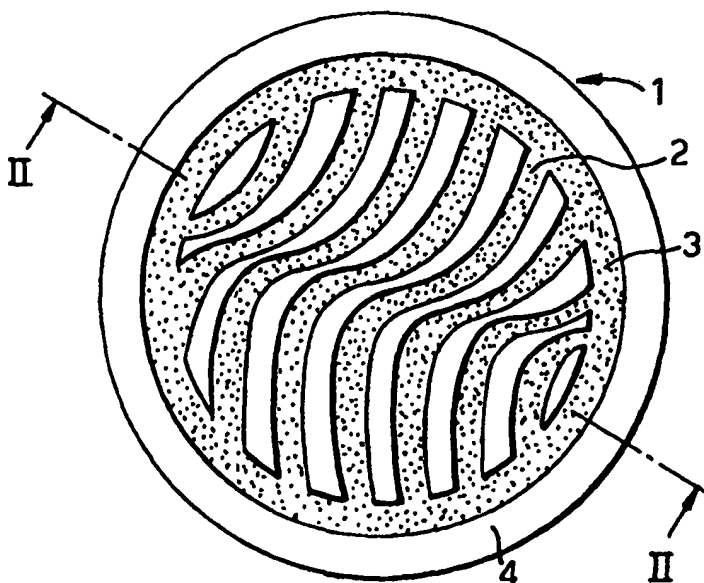


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(54) Title: VAPOUR DISPENSING DEVICE**(57) Abstract**

The present invention relates to a device for the diffusion of an active volatile substance into ambient air or closed spaces comprising a solid casing or housing and a solid carrier containing said volatile substance wherein said solid carrier is arranged in at least one recess formed in the housing, the at least one recess having a depth and a width which are chosen in relation to the composition of the solid carrier containing the active substance so that the ratio of the evaporation surface of the solid carrier to the mass of the solid carrier disposed within the said recess is such that a substantially constant vapour release rate and total evaporation of said active volatile substance during the active lifetime of the device is obtained. The recesses can be of various geometrical shapes in order to give a pleasant appearance. The active volatile substance can be a perfuming, deodorizing, sanitizing composition or an insect repellent.



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VAPOUR DISPENSING DEVICE

The present invention relates to the field of perfumery. It relates, more particularly, to a device
5 for diffusing perfume into the surrounding air. The device of the invention, however, can also be used for the diffusion of other active volatile agents, such as insect repellents, deodorizing or sanitizing agents, amongst others.

10 The use of various devices for the diffusion of volatile compounds, for example perfumes, sanitizing agents, insect repellents, and the like, has become more and more current in recent years. For example, air-freshening devices or deodorizers are currently
15 used in practically all households to mask bad odours or to impart fragrances to the ambient air. The known devices used for the diffusion of volatile compounds into the surroundings make use of various principles. As an example, one can mention here dispersing devices
20 of the spray type, aerosols or mechanical. Other examples include plastic packing elements enclosing the active ingredients in liquid form. Typically, the diffusion of the active ingredient takes place through membranes permeable to the vapours of said ingredient.

25 One class of systems capable of diffusing active volatile ingredients and which are of relevance with respect to the present invention are solid state devices consisting of solid materials or carriers impregnated with an active ingredient. Such devices
30 may be formed of various materials which are capable of absorbing the ingredient and subsequently releasing it in a more or less controlled manner. Examples of such known materials include gels, such as agar-agar or sodium stearate gels, synthetic polymer resins, or
35 blocks of mineral material, e.g. plaster or silica. It

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is even possible, for some purposes, to have active ingredients absorbed on paper or cardboard in order to obtain a more or less solid carrier device for diffusing the volatile ingredient thus absorbed.

5 Often, solid devices are designed to be non-wetting, i.e. to be capable of effectively retaining the liquid active volatile material and only allowing the diffusion of the vapours of said material.

10 Solid state air-freshener devices have the advantage that they are easy to handle and may be shaped into various forms adapted to the customers' needs and desires. The devices can for example be in the form of a solid block of a particular shape, e.g. a figure or a geometrical form, and be used as such. A
15 material often used for such devices is plaster, allowing an easy shaping of the raw material into the desired form.

Solid state devices can also be placed into a housing in which they are typically covered by a lid
20 or a grill having openings to allow for communication between the surrounding air and the perfumed solid block, or they can be arranged between two grills. In these applications, the solid perfumed block is covered by said lid or said grill and is sometimes
25 invisible from the outside of the packing. Unlike the unhoused air-fresheners, the appearance of the latter air-freshening devices is that given by the housing or the grill, and it is therefore not necessary, or not even possible, to shape the solid block into a
30 particular form to cause an aesthetic impression.

Solid block perfuming devices, however, generally have the drawback that the vapour release rate is not constant, but drops dramatically within the lifetime of the product. Furthermore, often the device is
35 already exhausted, i.e. no longer diffuses sufficient

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active ingredient, in spite of the fact that considerable amounts of active ingredient still remain in the core of the block. This residual perfume, retained by the material of the block, is therefore
5 entirely lost.

The object of the present invention is to provide a solid air-freshening device for diffusing volatile substances, e.g. perfumes, insect repellents, deodorizing or sanitizing agents, which is capable of
10 diffusing said volatile substances at a relatively constant rate throughout the lifetime of the device. Furthermore, the devices of the invention are capable of releasing practically their entire content of volatile substance within their effective lifetime,
15 such that very little active ingredient will be retained as a residue.

Accordingly, the present invention provides a device for the diffusion of an active volatile substance into ambient air or closed spaces comprising
20 a solid casing or housing and a solid carrier containing said volatile substance wherein said solid carrier is arranged in at least one recess formed in the housing, the at least one recess having a depth and a width which are chosen in relation to the
25 composition of the solid carrier containing the active substance so that the ratio of the evaporation surface of the solid carrier to the mass of the solid carrier disposed within the said recess is such that a substantially constant vapour release rate and total
30 evaporation of said active volatile substance during the active lifetime of the device is obtained.

The term "lifetime" in relation to the diffusion device of the present invention is used here to designate the period of time during which the device
35 diffuses an amount of active ingredient sufficient to

be effective, i.e. which, for example, can be perceived in the case of perfumes, or can remain active as insect repellent, deodorizing or sanitizing agent, and the like.

5 The solid casing or housing of the device of the invention can be formed of any convenient material into which small-sized recesses can be cut or moulded and which is adapted to be used as a bulk article. The material should thus be nontoxic and retain its form
10 upon storage or use. The material can, of course, show a certain flexibility. An important criterion for the choice of the appropriate material is its compatibility with the solid carrier containing the
15 volatile substance, such that the latter remains lodged in the recesses of the housing even after complete evaporation of the volatile substance.

 Preferred materials for the housing or casing include wood, mineral materials (e.g. plaster), glass, or synthetic polymers (e.g. acrylic and methacrylic
20 polymers, polystyrene, polyesters, phenolic resins or silicones). The solid housing may have any geometrical shape, for example a cylinder, a prism, a pyramid, a tetrahedron, a cube or a diamond. The geometrical shape is preferably chosen to have a pleasant
25 appearance.

 According to a preferred embodiment of the invention, the housing or casing is formed as a single block, having two substantially parallel faces, the lower face being flat, and the recesses being cut or
30 moulded into the upper face of the block.

 The materials which can be used to form the solid carrier incorporating the volatile substance are the usual materials known in the art as being appropriate carriers for the perfumes, or insect repellent,
35 deodorizing or sanitizing agents or the like used

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according to the present invention. These carriers are capable of incorporating a considerable amount of active substance, typically between about 5 and 90% of their total weight, and they are capable of retaining
5 the active substance, i.e. the latter will not flow out of the carrier material in any considerable amount, being intended to be released in the gaseous state from the carrier material into the surroundings of the air freshener.

10 Preferably, the solid carrier will be of a material capable of adhering to the housing or casing by itself. Whenever the carrier is made of a material which does not adhere sufficiently to the chosen housing, it may be made to stay on the housing by
15 means of e.g. an appropriate glue or polymer of synthetic or natural origin.

Non-limiting examples of appropriate carriers include plaster, silica, carboxymethylcellulose, wax-like materials (such as, for example, stearates or
20 paraffins), alginates, carrageenans (such as, for example, agar-agar), paper, cardboard, synthetic polymers [such as, for example, polyacrylates, polymethacrylates or polyurethanes, polyethylene, ethylene-ethylacrylate copolymer, ethylene-vinyl
25 acetate copolymer, a polyamide, a polyether block amide elastomer (e.g. Pebax®; origin: Elf Atochem)], polymer hydrogels (such as, for example, those disclosed in FR-A-2455068 or US Patent No. 4,362,841), or anhydrous polymer gels.

30 A preferred class of materials for the solid carrier incorporating the volatile substance are anhydrous gels such as those described in US patent No. 5,780,527 which are formed via the cross-linking of a functionalised liquid polymer selected from
35 maleinised polybutadiene or maleinised polyisoprene,

or a copolymer consisting of ethylene and maleic anhydride, with a cross-linking agent which possesses one or more complementary functional groups, in the presence of a perfume, deodorizing or sanitizing base or of a surfactant agent. In a preferred embodiment, a functionalised liquid polymer selected from maleinised polybutadiene of molecular weight 5,000-20,000 or maleinised polyisoprene of molecular weight 200,000-500,000 is used. Suitable cross-linking agents include dihydroxypolybutadiene, ethoxylated or propoxylated primary fatty amines, alkylpropyldiamines having an ethoxylated or propoxylated higher aliphatic chain, diethanolamine, diethylenetriamine and polyoxyalkyleneamines, in particular polyoxyalkylenediamines and -triamines. It is advantageous to use the functionalised liquid polymer and the cross-linking agent in a molar ratio of approximately 1:1. In the most preferred embodiment, the anhydrous gel results from the in situ cross-linking between a functionalised liquid polymer and a cross-linking agent consisting of either an oleylamine having 2 ethylene oxide units per molecule, a cocoamine having 5 ethylene oxide units per molecule, or polyoxyalkylenediamine or -triamine.

The gels which are obtained according to the above description are capable of absorbing large amounts of an active, volatile ingredient, e.g. a perfume, an insect repellent, a deodorizing or sanitizing base or the like.

The above-cited polymeric materials are all commercially available. As examples for maleinised polybutadiene or polyisoprene, one can cite the products known under the name of "Lithene®" [origin: Revertex Ltd]. Amongst the different qualities of available Lithene®, good results have been obtained by

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using "Lithene® N4-9000 10MA" [origin : Revertex Ltd];
9000 stands for the molecular weight of polybutadiene
before maleinisation, whilst 10MA indicates the degree
of maleinisation - in this case 10 parts of maleic
5 anhydride per 100 parts of polybutadiene (about 9.1%)
- Lithene N4-B-10MA, has also proven to be
particularly useful.

As examples of cross-linking agents, one can cite
the following agents

- 10 - alkylpropyldiamines having an ethoxylated or
propoxylated higher aliphatic chain : products
available under the name Dicrodamet (origin :
Croda Chemicals Ltd)
- ethoxylated or propoxylated primary fatty amines :
15 Crodamet (origin: Croda Chemicals Ltd), in
particular Crodamet 02 (oleyamine having 2
ethylene oxide units per molecule) and Crodamet C5
(cocoamine having 5 ethylene oxide units per
molecule)
- 20 - polyoxyalkylenediamines : Jeffamine® D and ED
series (origin : Huntsman Corporation), in
particular Jeffamine® D-400, Jeffamine® EDR-148
and Jeffamine® D2000
- polyoxyalkylenetriamines : Jeffamine® T-403.

25 One can also cite polybutadiene having a
hydroxylic function known as HFPB (origin: Revertex
Ltd) which gelifies when admixed with maleinised
polybutadiene. Sometimes, the use of specific
catalysts allows better control of the gel formation
30 and, to this end, there are used tertiary amines
(e.g.: DAMA 1010, a dialkylamine ; origin: Albemarle
SA). Mixtures of Hycar CTBN 1300 x 21, which is an
amine terminated liquid butadiene/acrylonitrile
copolymer (origin: B. F. Goodrich), and maleinised
35 polybutadiene are also suitable.

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As cited above, these anhydrous gels which are particularly adapted to be used in the present invention, are described in US patent 5,780,527 (assignee: Firmenich SA).

5 An important feature of the present invention are the small-sized recesses formed in the solid casing or housing and containing the carrier holding the active substance. In order to allow the desired constant vapour release and complete evaporation of the active
10 substance, the recesses must be of a sufficiently small size and have an appropriate depth and width. In other words, the solid carrier arranged within the recess and containing the active substance must have a high evaporation surface/mass ratio to allow
15 sufficiently rapid diffusion of the active substance which it incorporates to the surface of the device, so as to ensure the constant and regular evaporation of said substance. However, the ratio between the evaporation surface and the mass of the solid element
20 should not be too high, in order to prevent a "burst-like" and rapidly declining release of the active substance, i.e. the recess must not be too large or too shallow.

 When in the above there is made mention of the
25 evaporation surface/mass ratio, one can of course also use the evaporation surface/volume ratio in order to describe the same relationship, both values being easily convertible into each other via the density of the respective material,

30 A person skilled in the art will recognize that the appropriate size for the recess has to be selected as a function of, for example, the nature of the material of the solid carrier and its porosity (which may vary for a given material according to the mode of
35 preparation), the amount of active ingredient and its

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volatility, or the interaction between the solid carrier material and the active substance. All of these parameters can have an impact on the efficiency of diffusion of the volatile substance and the appropriate size of the recesses can thus be readily determined on a case by case basis.

Recesses of many different forms can be used in the device of the invention. As non-limiting examples, there are cited groove-, round-, oval-, square-, diamond-, star- or triangular-shaped recesses. The recesses may have a constant or variable depth and/or a constant or variable width. Generally, the geometrical form of the recesses is not critical for the devices of the present invention, as long as these are of the appropriate size, as discussed above. Typical shapes can be labyrinth- or serpentine-like for example, without any vertical walls or separations within the hollow volume of the recess.

When the device of the invention comprises several recesses, these can be arranged so as to be isolated from each other or to be arranged in a communicating manner. According to a preferred embodiment of the invention, the solid support comprises several communicating grooves.

It is clear that for a recess of a given size, the evaporation surface/mass ratio is considerably influenced by the height up to which the said recess is filled with the perfume-containing carrier. In a preferred embodiment of the invention, the recess or recesses are only partially filled with the solid carrier. The customer will thus not contact the carrier during normal use of the device. In order to avoid such contact, the recesses of the device of the invention are small in shape and filled up to a degree which will not allow a user to touch the solid carrier

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containing the active components with his fingers.
This applies likewise to adults' and babies' fingers,
and in this manner the device of the invention has the
advantage of complying with a variety of safety
5 regulations.

The recesses may be shaped on only one surface of
the support or, alternatively, on several of these,
e.g. two opposite surfaces or faces of the support.
Likewise, the recesses may be blind recesses or extend
10 through the entire thickness or width of the casing or
housing. Furthermore, multipiece devices may be
formed, for example two single face devices which are
attached back to back.

The recesses of the housing of the present
15 invention can be filled up partially or entirely with
the solid carrier or element containing the volatile
substance, via various methods which are known in the
art. For example, the solid carrier material can be
pressed mechanically into the recesses after having
20 been prior impregnated with the volatile substance,
e.g. perfume. This will be appropriate in the case of
paper or cardboard being used as the carrier. Other
methods include pouring, moulding or extrusion, which
methods will be mainly applied when the carrier
25 holding the volatile active substance is made of a
material which originally is in the liquid state and
is capable of solidifying or gelling after having been
introduced into the recesses. Materials showing this
property are for example plaster or synthetic
30 polymers, in particular the polymers disclosed in US
5,780,527.

The overall surface of the solid carrier which is
exposed to the air, after arrangement in the recess or
recesses of the solid support, typically ranges from
35 about 5 to 100 cm², preferably from about 10 to 50

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cm². Typical amounts of solid element range from about 2 g to 50 g, preferably from about 3 g to 30 g. The precise values for the abovementioned surface area and the amounts of solid element depend, amongst others, on the size of the diffusion device, the properties of the material of the housing or casing, e.g. its porosity or how much active ingredient it can incorporate, and the desired effect of the device.

In the case of the carrier materials as disclosed in US 5,780,527, the typical amount of carrier is from about 2 g to 20 g, preferably from about 3 g to 10 g.

A particular advantage of the device of the present invention lies in the possibility of forming recesses of various forms into said housing or casing or arranging these in various manners. In this way, the present invention allows the formation of geometrical shapes or arrangements on one or more of the faces or surfaces of the support designed to be exposed to the air, so as to give a pleasant and aesthetic impression to the user. The device can also be adapted to various tastes and preferences. The solid carrier containing the volatile substance plays an active role in the visual impression imparted to the consumer. However, unlike in other applications in which a solid, volatile substance containing material is shaped into a certain geometrical form and used as such as a diffusion device, the present invention makes it possible to obtain devices which are freely shaped as desired, but in which the user can be protected from touching, or getting into contact with, the solid carrier of the volatile substance even when the device is activated. As well as random geometric shapes, symmetrical patterns may be formed or a logo, brand name or word could be formed by the recesses of the device.

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When the diffusion device of the present invention comprises the solid gel element disclosed in US 5,780,527, the device has the further advantage that the gel can provide an end point indication of exhaustion of its activity, i.e. when all of the active substance has evaporated and the device no longer has any perfuming activity. This end point cue is provided by the shrinkage of the gel material, within the recess or recesses, which is perfectly visible. Often, also a cracking or tearing of the gel material is observed. This is particularly the case when the device of the invention comprises recesses in the form of grooves which are arranged in a communicating manner.

When the diffusion device of the present invention is unactivated, as for example during storage and before use, at least the surface in which the grooves were carved is covered by an appropriate material, impermeable to the vapours of the active substance, e.g. aluminum foil, in order to avoid evaporation of the active volatile substances. Upon activation of the device to diffuse the volatile substance, the aluminium foil or other protecting material, impermeable to the vapours of the latter, shall be removed.

As a perfume base there can be used in the device of the invention any composition currently used in perfumery. The latter can be made of discreet chemicals more often, however, it will be a more or less complex mixture of volatile liquid ingredients of natural or synthetic origin. The nature of these ingredients can be found in specialized books of perfumery, e.g. in S. Arctander (Perfume and Flavor Chemicals, Montclair N.J., USA 1969) or similar textbooks of reference.

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Although special mention has been made hereinabove of the perfuming effect exerted by the invention device, the same principles apply to the manufacture of analogous devices for the diffusion of deodorizing or sanitizing vapours, the perfume base being then replaced by a deodorizing composition, a bactericide, an insecticide, a repellent or even an attractant. By the term "sanitizing", we refer here not only to those substances which can enhance the degree of acceptance of the surrounding air by an observer, but also to those substances which can exert an attractant or repellent effect towards certain species of insects, for instance towards houseflies or mosquitoes, or else which can have bactericide or bacteriostatic activity. It goes without saying that mixtures of such agents can also be used.

The invention will now be described in greater detail by way of the following non-limiting examples, in which the abbreviations have the meanings known in the art and the temperatures are indicated in degrees centigrade, and with reference to Figs. 1 to 3.

Fig. 1 is a plan view of an embodiment of a device according to the invention;

Fig. 2 is a cross section view, along line 11-11, of the device represented in Fig. 1; and

Fig. 3 represents a plan view of the same device once exhausted, i.e. once the perfume has been evaporated.

Figures 4 to 6 represent other embodiments of the device according to the invention in the form of, respectively, a flower, a lemon and a disc.